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THE USE OF WOOD IN AMERICAN MACHINERY

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This brief description of how and where wood is used for machine parts was prompted by a request from C. I. B. (International Committee on Wood), an European agency interested in wood utilization. The information gathered with respect to American industries should also be of interest to American wood users and to the woodworking and lumber industries in general. In addition it contributes to a subject of current economic interest, namely, the future trend in wood consumption.

Some of the data presented are chiefly of historical interest, since in certain manufacturing industries wood has all but disappeared in current types of machinery. On the other hand, in some machinery lines wood parts have withstood the assaults of encroaching materials to a remarkable degree. The employment of wood for parts of machines of current manufacture is dictated largely by service requirements and cost. There are machine parts for which wood is apparently indispensable. For many other parts wood is giving satisfactory service at less cost than any material that might be substituted for it.

Machinery, for the purpose of this study, is limited to actual operating units in a fairly restricted sense, and does not include other items equally necessary to production, which may be termed accessories or equipment. For example, a paper machine is a highly developed piece of operating machinery. Tanks, vats, and chests are accessories required in papermaking. In most industries more wood is used in accessories and equipment than in machine parts. No attempt has been made, however, to cover the equipment phase of wood use, except in the pulp and paper industry, where it was found very difficult at times to make a clear-cut distinction between machinery and equipment.

All industries having machinery that employs wood parts obviously cannot be covered in this brief survey. Many industries not considered probably use more wood for machine parts than some of those covered. The lines of machinery selected for consideration are fairly representative of machinery in general and should afford a good insight into the extent and kinds of wood used for machine parts.

Agricultural Machinery

The use of wood in agricultural implements is steadily declining. Apparently it must be proved that wood members in farm equipment

are the equal of or superior to members made of other materials, and where equality of service exists it must be shown that wood can be installed at a lower cost, to make its use possible.

A study of the current use of wood in agricultural machinery reveals that handles of wood are holding up very well. All types of walking plows, hand corn and cotton drills, and hand and horse-drawn cultivators are equipped almost universally with wood handles. The species used are chiefly oak and ash. Wood handles have advantages over other materials in that they are easily fabricated, can be readily replaced, and are low in cost. Wood handles also afford a comfortable grip in service regardless of prevailing temperatures, which is an important factor contributing to their wide use.

Plow beams of wood are apparently on the way out, except for special equipment. Heavy duty plows are made with oak beams, heavily reinforced with steel. Standard plows are practically all equipped with steel beams. Substitution of steel for wood in standard plows was largely the result of production difficulties, three of which stand out prominently: high loss of stock from warping and checking during seasoning, difficulty of obtaining a regular and constant supply of beams, and difficulty of adapting beams to the various forms required.

Hitch parts in earlier days were wholly of wood, chiefly oak and hickory. Today practically all horse-drawn farm machines are equipped or can be supplied with metal singletrees and eveners. Poles continue to be of wood, chiefly southern yellow pine and Douglas fir.

Grain drills have stood up well against changes in materials of construction. The old standard wood seed box and wood wheels can still be had in drills, but the all-steel drill is rapidly replacing the composite type. Implements for preparing soil for crops, in which wood was formerly used in large amounts, now contain practically no wood. Some items still have wood platforms, generally hardwood, for weighting with rocks or iron. Wood bar harrows are occasionally made and disc harrows have hard maple bushings.

Harvesting and threshing machinery likewise contain few wood parts. Reel bars and arms, chiefly of yellow pine; pitmans of hickory or hard maple; conveyor slats of oak, hard maple, or similar hardwoods; occasional elevators, divider boards, gatherer boards, and bundle conveyors, all chiefly of southern yellow pine, constitute the bulk of the few remaining items of wood used in the construction of harvesting and threshing machinery.

A bright spot in the agricultural machinery field is the extensive use of wood in haying tools. Hay loaders have conveyor slats of maple, oak, or similar hardwoods, and conveyor guides of yellow pine or Douglas fir. Sweep rakes are almost wholly of wood. The long, heavy, square teeth and the framework of the machine are chiefly southern yellow pine. Hay stackers are also principally wood, most of which is southern yellow pine.

The substitution of metal for wood parts of farm machinery, apparently largely a matter of production, often has little to do with the utility of the material displaced.

Flour Milling Machinery

Probably no other important industry employs a higher proportion of wood in the construction of machinery than flour milling. Many of the machines are almost wholly of wood. Roller mills (grinding machines) are the one notable exception. Flour milling machines are of sturdy construction. Conditions of service of these machines are conducive to long life and replacement is largely due to remodelling of plant or obsolescence.

The principal items of flour milling machinery are roller mills, sifters, purifiers, bran dusters, and rolls. Malt cleaning and crushing machinery is a closely allied item in which considerable wood is employed.

Wood used in the construction of flour milling machinery is rather highly standardized as to species and quality of material. Some of the machines are subjected to a continuous oscillating movement in use. All must withstand considerable vibration under operating conditions. The framework of the various machines must therefore be strong and able to withstand constant wracking in service. Wood used in housing machines should be light in weight, and have little "come and go" with normal changes in moisture content thus insuring tight joints at all times. Also the wood should remain in place well with a minimum tendency to warp.

Hard maple is preferred for the heavy framework of all flour mill machines. When hard maple is not available yellow birch is used for machine frames. Posts, top and bottom members, and other frame parts in the larger sizes are approximately 3 by 5 inches in cross section. White ash is extensively used for bracing, door frames, and collector sides. Northern white pine is the standard species for housing, sheathing, conveyors, and similar items where light weight and tightness of construction are essential. Douglas fir is occasionally used for conveyor sides, replacing white pine. Sieve frames of flour sifters are basswood; the cross bars are hard maple. Flour sifters are supported by a series of rock elm rod assemblies. There are usually eight rods in a group and two sets of rods are required for each sifter.

The encroachment of other materials in flour milling machines has in general not been extensive. Roller mills are of metal except for the housing, which may be either of wood or metal. Few roller mills with metal housing are sold because of their additional cost. Sieves of flour sifters are obtainable with aluminum frames, also at added cost. The interior moving parts of rolls are sometimes of metal, replacing wood. Bran dusters can be had in an all-metal construction. Malt

cleaning and crushing units are of all-wood and all-steel construction. The increased use of steel in the last mentioned two items is of fairly recent development.

Textile Machinery

In the textile industry the heavy framework of looms is gradually being replaced by steel angle irons. Less wood and more steel is being used in the fabrication of laywoods. Canvas picker stick connectors are replacing to some extent hard maple and ash. In some paperless beams, low carbon steel is replacing Sitka spruce. Pressed steel sheaves are sometimes installed in the larger looms in place of the hard maple sheaves. In general, however, wood is holding up well in the construction of textile machinery.

Wood in the textile industry is employed for parts where the requirements are usually very exacting. One of the largest loom works reports that in the construction of a wide variety of looms, seven species, namely ash, hard maple, birch, hickory, applewood, yellow poplar, and Sitka spruce, comprise more than 99 percent of the total wood used for machine parts.

The most important requisite of any wood used for loom parts is its ability to remain straight and true in service. Also of utmost importance is freedom from checking in use. These requirements can be satisfied by selecting straight-grained stock and by proper seasoning. Where large sizes are needed the parts are commonly built up in order to avoid warping and checking in service. In addition to the general properties just named, there are several types of uses of wood in looms that have individual requirements. These requirements are given in the following paragraphs.

Beams and Rolls

Beams in this category are cores of large spools upon which warp is wound. The warp is delivered to the loom from the "spool" and only the first winding comes in contact with the wood. Sitka spruce is used exclusively by one large firm for beams. Yellow poplar is employed to some extent by other manufacturers for that purpose. Beams are either solid, in sectors, or built up. Sitka spruce and yellow poplar have sufficient strength for beam use, are light in weight, and machine well with a minimum of splintering, all of which contribute to their high serviceability for beams.

Rolls are largely guides for the warp and cloth. Aside from stiffness and strength required of a wood for rolls, it must be hard, uniform textured, nonsplintering and wear-resisting. A smooth surface is essential at all times. The wearing surface of this type of roll is exclusively hard maple. Small rolls are solid; large rolls are

built up with yellow poplar ends and Sitka spruce centers. Cloth guide-rolls of certain types are Sitka spruce, particularly the large covered rolls of built-up material. Rolls which receive the finished product are also largely of spruce.

Framework, Connectors, and Beams for Attachment of Working Parts

The added requirements for most of the wood parts in framework, connectors, and attachment beams are high strength and hardness, good wearing qualities, and high shock resistance. Apparently white ash satisfies these requirements very well, since, except for a small amount of hard maple, it is the wood most used for the purpose.

Shuttle Racks, Runs, and Shuttle Tops

Wood for shuttle racks, runs, and shuttle tops must be hard and wear resisting, and must remain smooth in service. By far the most extensively used wood for such purposes is apple. Dogwood is used in smaller amounts. For the most exacting parts Turkish and West Indian boxwood are employed.

Picker Sticks and Connectors

The requirements of a wood for picker sticks are most exacting. The ideal wood should be light in weight, very strong, tough, and resilient. Hickory conforms most nearly to the requirements for picker sticks, and hence is universally used for that purpose. Picker stick connectors are of hard maple and ash because of their high strength and general serviceability.

Sheaves, Bearings, and Similar Items

Sheaves, bearings, and similar items are of hard maple. The hardness and ability of maple to wear smooth in service adapts it well to such uses. When employed for bearings and bushings, maple is made self-lubricating by impregnating with oil. The extensive use of oilless bearings in the textile industry is due to the fact that they reduce the hazard of soiling cloth-making materials.

Dobby Bars and Cylinders

Bars and cylinders of dobby looms are constructed chiefly of birch and hard maple. Both uses require a hard, strong wood that wears smooth in service and is not splintery in boring. Birch, according to one large manufacturer, splinters less than hard maple and is therefore preferred.

Dairy Products Machinery

Wood in machinery for making dairy products is confined largely to churns, cheese vats, and cheese presses. Smaller items, such as hand butter workers, butter printer boxes, ladles, and packers, are also chiefly of wood.

The requirements of wood in dairy products machinery are quite exacting. Of first importance is the matter of freedom from imparting objectionable odor or taste to the manufactured product. The wood should also be strong, stable in service, and have low shrinking and swelling in use. This requirement is attained by employing only edge-grained material. High decay resistance is also essential. Other factors being equal, the cost of lumber for items requiring stock of large sizes limits to some extent the species used.

Commercial butter churns are essentially closed tanks of various sizes to suit individual requirements. The cylinders and heads of churns made by one of the largest manufacturers of commercial dairy products equipment are of clear heart vertical grain Douglas fir. The staves are of various thicknesses, ranging usually from 1-1/2 to 2 inches when finished. Douglas fir stave stock is purchased rough, and is surfaced, tongue and grooved, and run to the proper curvature in one operation. The width of staves is uniform for churns of all sizes, nominally 4 inches. Churn heads are of stock 10 to 12 inches wide. Churn shelves are also of clear heart vertical grain Douglas fir. Butter rolls are redwood. Each roll is made from a 7 by 7-inch or a 10 by 10-inch redwood timber. The stock is practically green when used. Churn doors are of 1-inch redwood, Douglas fir, or cypress, usually in one piece, up to 18 inches in width. Vertical grain stock is preferred.

Cheese vat frames are of vertical grain Douglas fir of the same quality as for churns. The stock is wide and occasionally in the larger vats 2-1/2 inches thick. Douglas fir is also used in large sizes for cheese press frames. Redwood is occasionally used for cheese vats and presses on special order.

Hand butter workers are hard maple. Butter print boxes are heart yellow poplar. The sides are of one piece 18 inches wide. Ladles and packers are usually hard maple.

There has been no substitution of other materials for wood in commercial churns. The wood used, however, has changed with time, due to difficulties in obtaining suitable material or to high cost. Early churns were commonly of yellow poplar and cypress with yellow poplar rolls. Hard maple was also used for rolls. Douglas fir and redwood, the species currently used for cylinders, shelves, and rolls, are apparently satisfactory in use and are readily available in the sizes, types, and grades required.

Cheese vats and presses can be had of all-metal construction. The use of metal vats is increasing.

Board Drop Hammers

Board drop hammers are in common use in the production of certain types of forgings. The essentials of such equipment are the ram to which the board is attached and the rolls which, pressing against the board, lift the ram to the height desired for dropping. Clamps are sometimes used for gripping the board instead of rolls. Hammer boards are invariably of hard maple. Many other species have been tried, but none seems to be as satisfactory as maple. Boards range in thickness from 1-1/4 to 1-3/4 inches, in width from 2-1/2 to 16 inches, and in length probably from 6 to 12 feet. The most commonly used finished board sizes appear to be 1-9/32 to 1-1/2 inches thick, 5 to 6 inches wide, and 8-1/2 feet long. Boards over 8 inches wide are built up of two or more narrow pieces.

Hammer boards are subjected to hard usage. The life of a board in service may be only a few minutes if serious hidden defects are present, or 300 or more operating hours under favorable operating conditions. The average life of hammer boards in service is probably somewhere between 50 and 100 operating hours.

Hard maple for hammer boards must be straight grained, flat, sound, and dense. The wood must also be thoroughly seasoned. Failure of the wood in hammer boards is due largely to crushing of the board where gripped by clamps or where the rolls start in raising the ram. The shock sustained by the board at moment of impact is likely responsible for failures through splitting. Boards seldom if ever fail due to the load being lifted.

The volume of maple used for hammer boards cannot readily be estimated. Manufacturers of hammers furnish some boards, but the bulk of the stock is supplied by local dealers. There is at present no substitute material replacing hard maple for hammer boards as far as can be determined.

Commercial Laundry Machines

Wood in laundry machinery is confined chiefly to washers. The conditions which have to be met in a material for washers involve largely corrosion in contact with chemicals employed in washing processes, and contamination or staining of the clothes. Wood resists chemical action and contains no substances injurious to fabrics.

Commercial washers consist essentially of two parts, the shell or stationary tub, and the interior cylinder. The shell in the best

grades of washers usually has heart cypress staves and heads. Other softwoods having high decay resistance are probably also suitable for shells in the better grades of washers. Lower priced washers have tubs of Douglas fir. Both staves and heads are usually of 2-inch material. Heart cypress and Douglas fir have sufficient strength for tub use, hold fastenings well, resist action of chemicals, and are resistant to decay.

Washer cylinders are commonly of heart longleaf pine. This species is preferred for cylinder parts because of its high resistance to wear under action of chemicals employed in washing. Cylinders of longleaf pine and similar woods are strong and rigid and hold up well in service. In the better grades of washers, heads of cylinders are of 3-inch stock. Staves are generally 2 inches thick.

Hard maple lifting ribs are the rule. Hard maple has the high wearing and nonsplintering qualities required in a wood for rib use. Doors and door ribs are commonly of the same species as the staves.

Current types of commercial washers show some replacement of wood by other materials. Washers with brass cylinder partitions and doors and with monel metal lifting ribs are available in the higher priced lines. Galvanized iron doors are replacing wood doors in the cheaper grades of product.

Pulp and Paper Machinery

The use of wood in the construction of pulp and paper plants is declining with each new mill installation. Wood when employed is confined to structural units, such as conveyors, chip bins, and other component parts of the building and in more or less nonoperating items, which to differentiate them from operating machinery, may be classed as equipment. In this category are storage tanks, vats, screen boxes, bins, pipes, tubs, and chests.

It is obviously difficult in many cases to separate equipment from the machinery it serves. Since the bulk of wood used in pulp and paper manufacturing processes is employed in items defined as equipment, it may be well to cover briefly the use of wood in that classification.

Species used for containers of liquids and pulp mixtures are the regular tank and vat woods, principally cypress, redwood, Douglas fir, and southern yellow pine, including longleaf, generally of tank grade. From the standpoint of service other species can be substituted in some types of tanks and vats; the foregoing woods, however, are readily available in stock sizes, which is a considerable advantage when purchasing tank lumber. The species employed for tank, vat, tub, or chest depends on the type of use to which the container is put. Containers of southern yellow pine and Douglas fir are commonly employed for storing chemicals in which chemical action on the wood is the principal cause of failure.

Stock ready for the paper mill, because of frequent washings is free of injurious chemicals. Deterioration of various wood containers used in the latter stages of papermaking is therefore due largely to decay. Where long life is desired of such containers, heart cypress is commonly employed in their construction. Heart redwood is probably equally suitable. Quite commonly, however, little attention is paid to species for tank and vat construction as between the various species mentioned. Douglas fir and southern yellow pine are less expensive than redwood and cypress, and that consideration is sometimes the determining factor.

Pipes carrying stock or water are often of wood. Douglas fir and redwood are commonly used for stave pipe. Wood pipe is preferred by many to pipe of other materials because of its low tendency to "slime," and its relatively low cost.

Wood in pulp and paper equipment is rapidly being displaced by metal, concrete, rubber, and other materials in new installations and also often in replacements. Tanks, vats, sieve boxes, and similar items are principally affected. These items will probably continue to have certain wood parts, such as agitation arms, which are of hardwood -- chiefly hard maple, oak, and ash; cylinder fins for elevating pulps in deckers; some wood couch rolls in wet machines of a variety of species, such as hard maple, black gum, cypress, yellow poplar, and yellow pine; and filler strips between beater bars, chiefly of hard maple and oak. The total incidental wood employed in modern equipment for making paper is small, with little apparent chance of future increase.

A still smaller volume of wood is used in pulp and papermaking machines, especially in machinery of the latest designs. The machine that probably uses the largest amount of wood is the "jordan," which consists essentially of an outer shell with a cone-shaped plug. The filler strips between the metal bars of both shell and plug are hardwood, chiefly red oak and sugar maple.

"Save-alls" at the front end of paper machines are often of wood construction. Cypress or some other decay-resistant softwood of tank stock grade is commonly employed for this item. The "shock absorber" attached to a shaker is of wood, usually hard maple. Suction box covers are hard maple, or some other long, even-wearing species. Recent paper machine installations have suction box covers of bakelite.

Press rolls of wood are obsolete. Felt rolls are of yellow poplar, basswood, or some other soft fine-textured species. New materials for rolls include rubber metal, various compositions, and granite.

Wood Bearings and Bushings

Bearings and bushings of wood have been used in machine construction for many years. Although developments in machine design and materials have eliminated wood bearings in many types of equipment there

are still certain machines in which nothing appears to be more suitable for bearing use than wood. Improvements in wood bearings and bushings, in recent years have increased their usefulness considerably, and new uses for those items have been developed. Practically all wood bearings and bushings are now impregnated with lubricating material. The result is a bearing that needs no oil during its useful life.

Oilless bearings and bushings have four principal uses for which they are well adapted: for use in locations difficult of access; where oil or other lubricants would soil or damage the product being made; where use conditions require occasional or frequent removal of bearings; and where use of ordinary lubricants is impractical or impossible.

Probably the most general use of wood bearings and bushings is in textile machinery, where danger of damage through soiling of fabrics in the various processes of manufacture must be kept to a minimum. For similar reasons wood bearings are extensively used in washing machines and wringers. Certain types of agricultural machinery are equipped with wood bearings and bushings, notably disc harrows. When worn out or broken in such use they can be quickly and cheaply replaced. Wood bearings are employed in equipment that is constantly submerged in water or other liquids in service. The use of ordinary lubricants under such conditions is obviously impossible. In addition to the foregoing uses, wood bearings and bushings are employed in flour machinery, shoe machinery, paper folding and envelop equipment, cream separators, cash carriers, vacuum cleaners, wells and pulps, scientific instruments, hydraulic equipment, and stern bearings for ships. For the last named two purposes lignum vitae is the principal wood used.

Practically all wood bearings and bushings are of hard maple. The type of maple employed is usually northern grown clear sap stock. For some uses beech is satisfactory.

There are a number of firms making wood bushings and bearings though the market for them so far as number of outlets is concerned is probably decreasing. In equipment that employs large quantities of wood bushings and bearings, however, such as agricultural implements, textile and laundry machinery, the volume of wood consumed is still large and may actually be increasing. Because of the nature of the industry no figures on consumption of wood for bearings and bushings are available.

Wood Pulleys

The use of wood for pulleys probably dates from the first use of belts or similar contrivances for transmitting power. With the passing years, improved design and better construction have combined to keep wood pulleys on the market in competition with those of metal and other materials of which there are countless designs, kinds, and types. The

production of wood pulleys has undoubtedly fallen off in recent years, but one company of the half dozen or so that make wood pulleys still uses almost half a million feet of lumber annually in their construction.

Wood pulleys are of two general types -- split pulleys and solid pulleys. Split pulleys are of two identical parts each consisting of a wood face made up of narrow glued members, and wood arms, one, two, or more depending on the size or design of the pulley. The faces or rims of wood pulleys are of basswood, sap gum, tupelo, and probably other hardwood species in small amounts. Pulley arms are commonly of hard maple and beech. Bushings are hard maple or sometimes beech. Solid pulleys are commonly hard maple.

Manufacturers of wood pulleys assert that lightness of weight and high strength combined with high coefficient of friction make it possible to run such pulleys safely at higher speeds than pulleys of other types of construction.

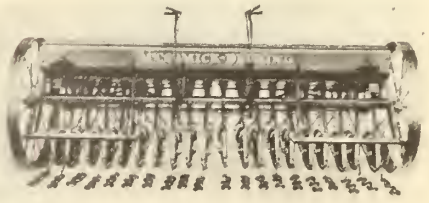
AGRICULTURAL MACHINERY

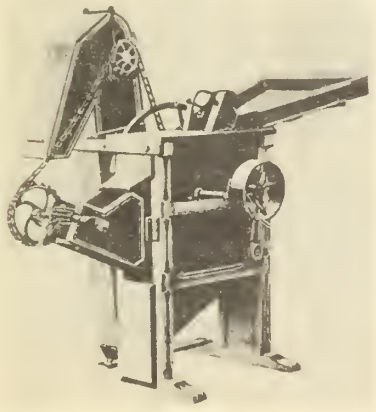
The substitution of metal for wood parts of agricultural implements has, during the past two decades, reduced the volume of wood per unit of production about one-half. One line of equipment that has withstood the attack of steel is haying tools. At the right is a swing rake. Standard equipment of this type is almost wholly of wood, chiefly southern pine.

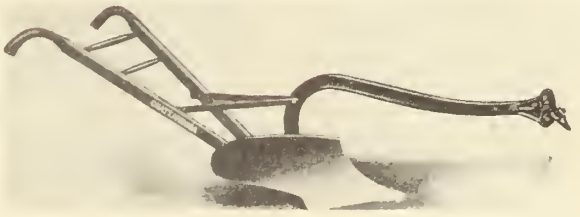
The grain drills also shown at the right represent a class of equipment in the construction of which wood is gradually being replaced by metal. The drill at the top has a wood seed box and wood wheels. Below it is a drill made wholly of metal.

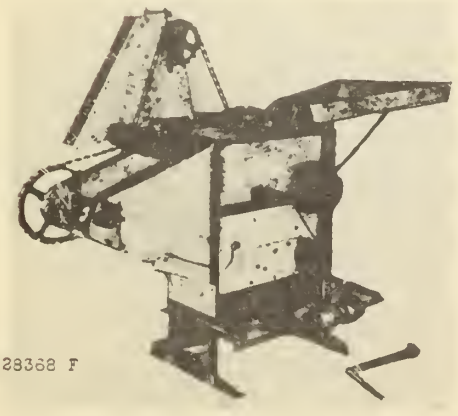
Below is a cut illustrating a 1914 model corn sheller almost wholly of wood. The 1932 model shown below it has changed little in appearance, except that no wood is used in its construction.

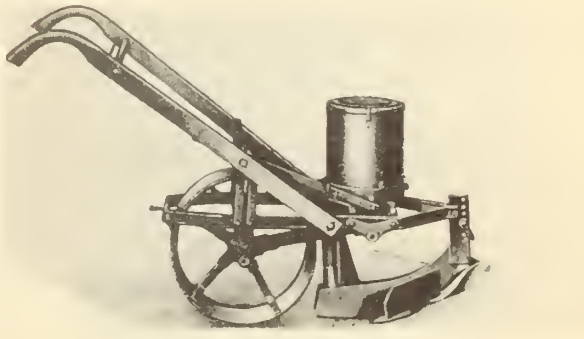
The old reliable oak plow beam has been relegated to special item class. Handles of walking plows, cultivators, and similar items, however, are still universally of wood, principally oak and ash.











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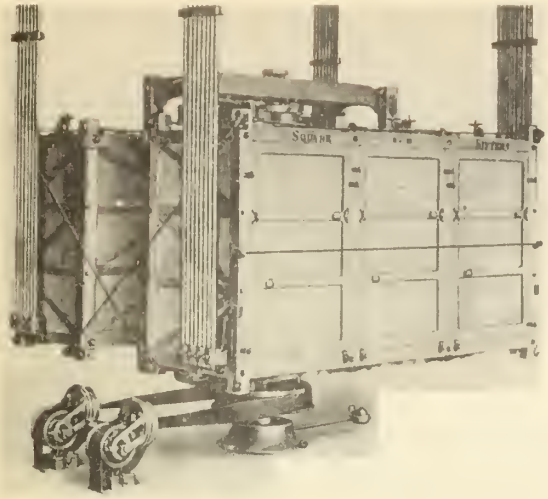
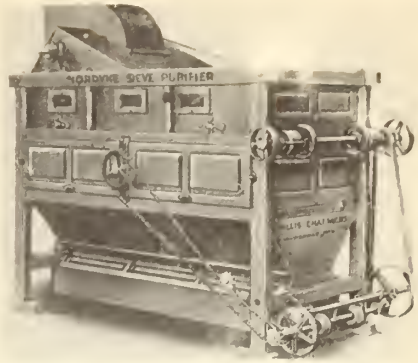
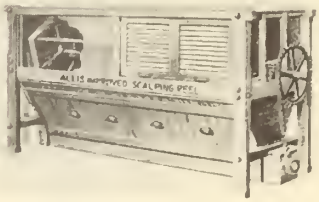




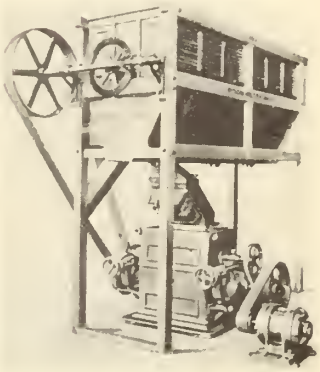


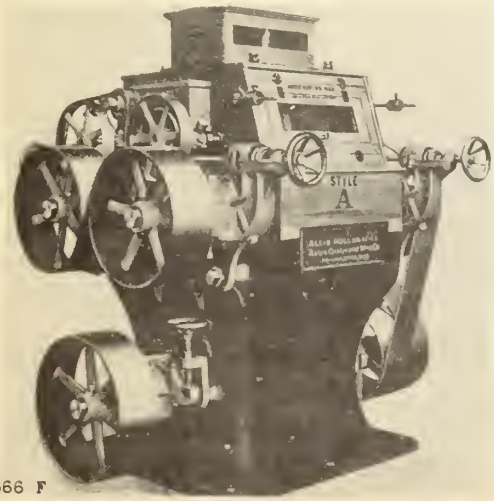
FLOUR MILLING MACHINERY

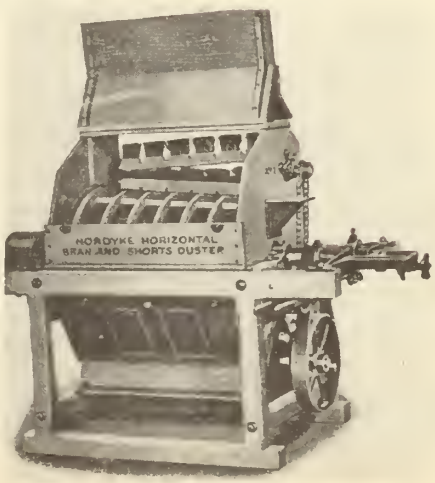
Changing Sieves of Nordyke Square Sifters

Wood occupies a commanding position as a material in the construction of all types of machinery used in flour manufacture. A glance at the items illustrated indicates the extent to which wood is employed. The heavy framework of all the machines shown, except the roller mill, is of clear hard maple. When the proper type of maple is not readily available, yellow birch is sometimes used for frames. Smaller items of framework, bracing, door stiles and rails, and hopper sides are ash. Housing and panels are northern white pine. Flour sifters are supported by a series of rock elm rods one inch in diameter. Sifter sieves have basswood sides and cross bars of hard maple.

Wood is especially well adapted for flour milling machinery. The heavy wood construction of the various machines resists very well wracking and vibration which are the primary causes of their deterioration. The clean, sanitary appearance of wood is an important asset in its use in flour production.



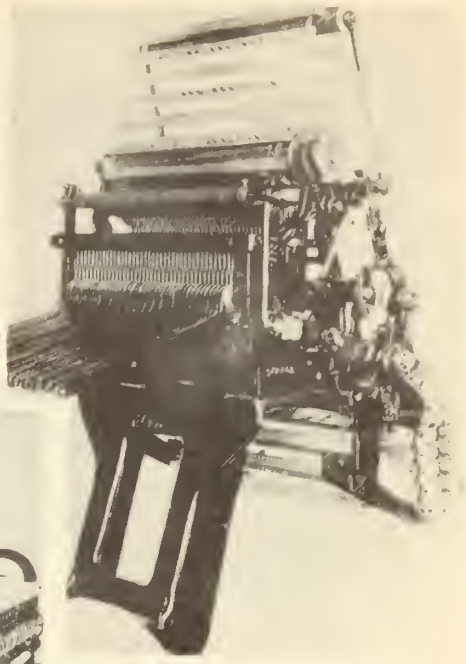


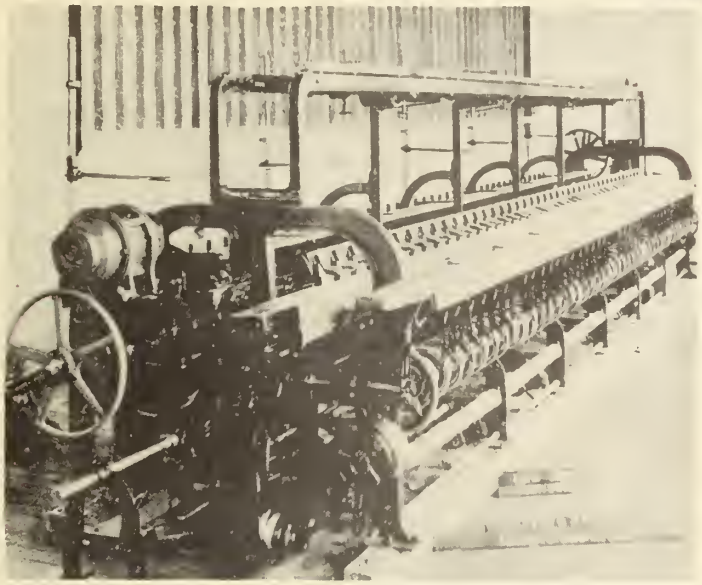


TEXTILE MACHINERY

Wood is an important item in the construction of looms and other textile machines. For many machine parts no satisfactory substitute for that material has been found. Aside from the more general properties required of all wood employed, special requirements for individual machine parts are very exacting, and limit the woods used to a very few species. Hard maple, yellow birch, hickory, ash, applewood, yellow poplar, and Sitka spruce comprise the bulk of wood used in looms.

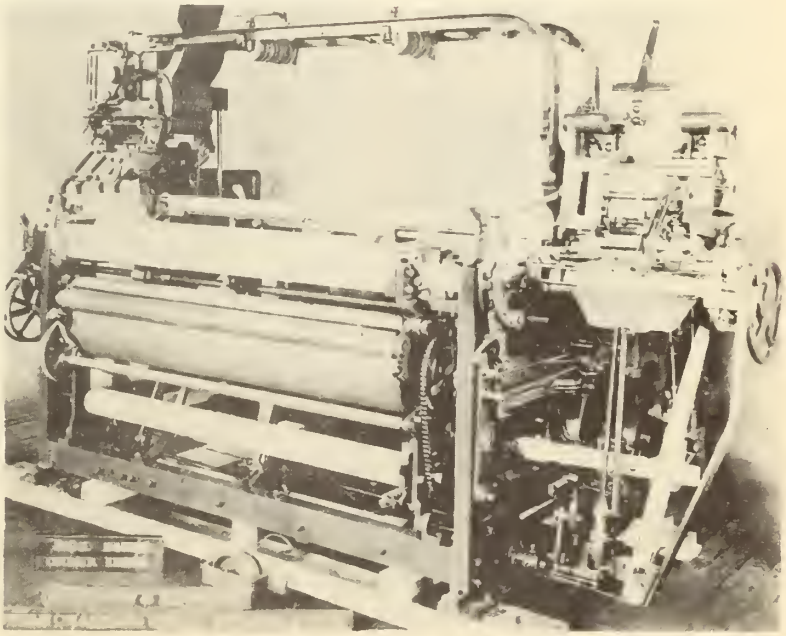
The heavy wood framework in the loom shown below is ash. Applewood is extensively used for circular shuttle covers. The shuttle assembly is the piano key-like arrangement running the length of the loom. It is supported by ash beams. The beam uprights in the background are also ash.





The dobby loom above has cylinders of hard maple. The bars passing over the cylinders commonly are yellow birch. Hard maple is also used for cylinder bars.

At the right is a typical silk loom. The rolls in the foreground are Sitka spruce. The breast board tray above the rolls is yellow poplar. Sheaves shown at the top are hard maple. The upright piece at the lower right is the picker stick which is invariably of hickory. The horizontal picker stick connector is ash.



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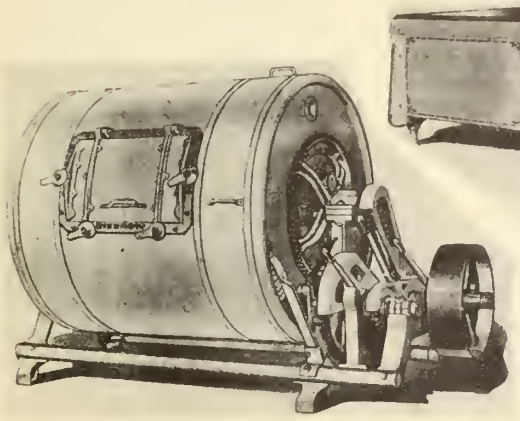
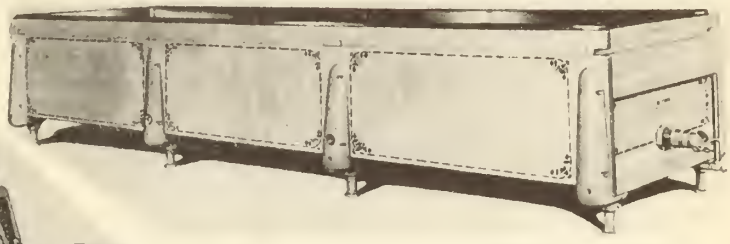
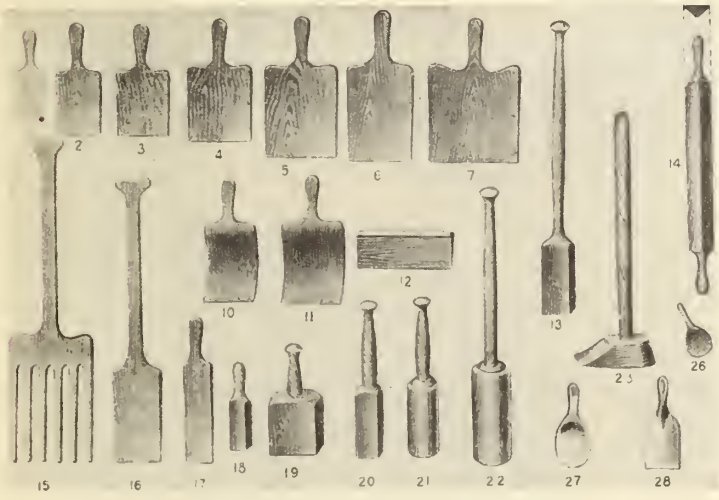
COMMERCIAL DAIRY MACHINERY

Wood retains its supremacy in many of the larger items of machinery in the dairy products field. No other material has replaced wood in butter churns. The churn cylinder is commonly of clear edge-grain Douglas fir heartwood. Churn doors formerly of cypress are now largely edge-grain redwood. Shelves attached to the sides of the churn are usually Douglas fir. The large butter rolls are redwood. The illustration at the right shows the arrangement and extent of use of wood in commercial churns.

Cheese vats and cheese presses illustrated below are of Douglas fir construction. All-steel vats and presses are available at considerably greater cost.





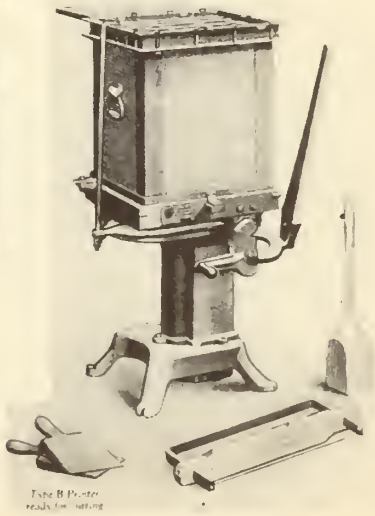


IMPLEMENTS EMPLOYED IN BUTTER MAKING AND PACKING

All of the items illustrated above are of clear hard maple. Beech and birch are also used for ladles and paddles employed in butter making.

BUTTER PRINTER
(Below)

The sides of the printer are clear heart yellow poplar in one piece.



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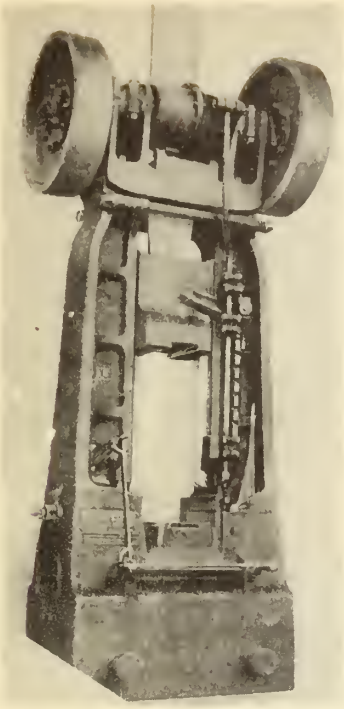
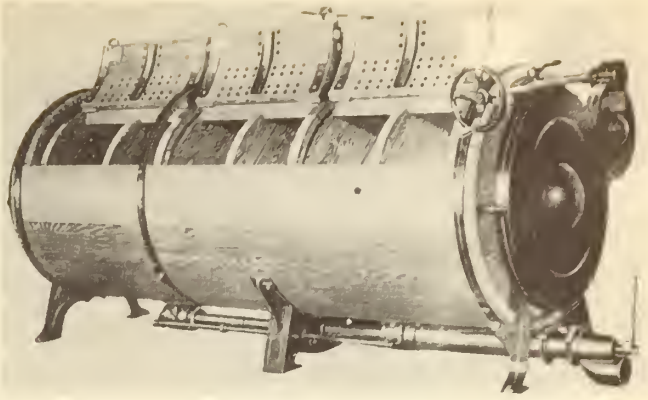


BOARD DROP HAMMERS

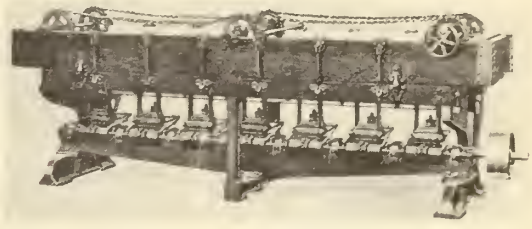
The type of forging hammer shown above employs a board for lifting the ram into position for the drop. Nothing but clear straight-grained hard maple is used for hammer boards. High resistance to side compression and ability to absorb shock are essential in a wood for that use. The average life of hammer boards ranges from 50 to 100 working hours.

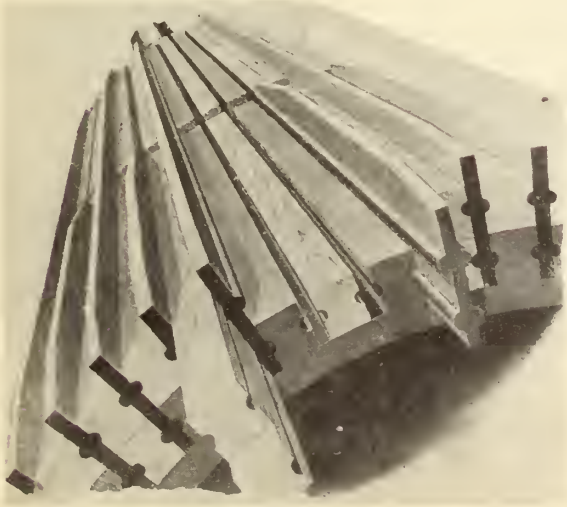


COMMERCIAL POWER WASHER

Wood continues to be used in considerable quantities in commercial laundry machines. The requirements of construction materials are exacting. They must stand up under the action of chemicals and impart nothing that will damage clothes in the washing process. No low-priced material is as serviceable as wood in power washers. The shell of the washer shown above is Douglas fir. Cypress is used for the more expensive shells.

The interior cylinder and partitions are usually of longleaf pine. Lifting ribs (not shown) are commonly hard maple.





PULP AND PAPER MACHINERY

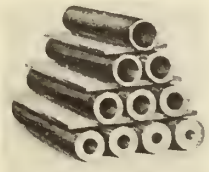
Wood in machinery employed in the paper industry is on the decrease. Tanks, tubs, vats, sieves, and similar equipment formerly almost wholly of wood are in new installations often of steel, concrete, and other materials. There is little wood used in operating machinery. The illustration at the left shows wood bars in the tapered plug of a "jordan." The stationary shell in which the plug revolves is similarly equipped with wood fillers. The wood used is chiefly oak.

The eccentric screen shown above and similar screens have sides, ends, and other parts of wood. The species employed is commonly cypress. Other softwoods having high decay resistance are also suitable for screen use.

BEARINGS AND BUSHINGS

Wood bearings and bushings were quite commonly employed in early factory and shop equipment. For certain uses they have maintained themselves in spite of great advances in engineering practice in recent years. Practically all wood bearings and bushings are impregnated with oils, waxes, paraffin, or similar materials to provide oilless lubrication. Such lubrication is essential in machines where ordinary lubricants will damage goods in the process of manufacture, for example, textile products. Wood bushings and bearings are employed in locations difficult of access. They are also extensively employed in agricultural machinery, notably disc harrows, because of their easy replacement and low cost.

Wood bushings and bearings are chiefly sapwood of hard maple. That wood is strong, fine-textured, wears well, and impregnates readily.



Wood Bushings

WOOD BEARINGS OR ODD SHAPES, EITHER TREATED OR UNTREATED

WOOD SPLIT PULLEYS

Pulleys of wood were formerly in quite general use in mills and factories and are still employed to a considerable extent in some industries. The chief advantages claimed for wood split pulleys are their lightness, ability to run at high speeds without danger of breaking, and non-slipping property. Wood pulleys can readily be made in any size and type. They are also relatively inexpensive.

The faces of wood-split pulleys are built up of parallel curved strips of basswood, sap gum tupelo, and probably other hardwoods. The arms are of hard maple or occasionally beech. Wood pulleys are often equipped with hard maple bushings.

As built in sizes [illegible] diameter and larger

[illegible] in. diameter. Standard bore 1¼ in.

Solid or Block P[illegible]

Block pulleys are commonly of hard maple.